WHAT IS CLAIMED IS:

1. A magnetic recording medium comprising a non-magnetic substrate, an orientation-determining layer, a non-magnetic undercoat layer, a magnetic layer, and a protective layer, in order, wherein:

the non-magnetic undercoat layer has a bcc structure;

the orientation-determining layer causes the non-magnetic undercoat layer to have a predominant orientation plane of (200) and has a crystal structure in which columnar fine crystal grains are inclined in a radial direction;

the ratio of a coercive force in a circumferential direction of the magnetic layer (Hcc) to a coercive force in a radial direction of the magnetic layer (Hcr) is more than 1; and

the magnetic layer includes a plurality of magnetic films having an hcp structure and a predominant orientation plane of (110), and permits antiferromagnetic bonding to be formed therebetween.

2. A magnetic recording medium according to claim 1, wherein the magnetic layer has a laminated ferrimagnetic structure in which the directions of the magnetic moments of adjacent magnetic films are opposite to each other.

3. A magnetic recording medium according to claim 1, wherein the magnetic layer has a structure including a plurality of magnetic films and an intermediate film provided therebetween.

4. A magnetic recording medium according to claim 1 , wherein the magnetic layer has two or more laminated structures, each including a magnetic film and an intermediate film adjacent thereto.

5. A magnetic recording medium according to claim 1 , wherein, among the plurality of magnetic films, a magnetic film adjacent to a primary magnetic film having the largest coercive force has an antiferromagnetic bonding magnetic field larger than the coercive force of the magnetic film adjacent to the primary magnetic film.

6. A magnetic recording medium according to claim 2 , wherein the intermediate film comprises a material predominantly containing at least one element selected from the group consisting of Ru, Cr, Ir, Rh, Mo, Cu, Co, Re, and V.

7. A magnetic recording medium according to claim 1 , wherein the orientation-determining layer comprises one or more elements selected from the group consisting of Cr, V, Nb, Mo, W, and Ta.

8. A magnetic recording medium according to claim 1 , wherein the orientation-determining layer comprises an alloy predominantly containing Cr.

9. A magnetic recording medium according to claim 1 , wherein the orientation-determining layer predominantly comprises a Ta-containing alloy X_1Ta, wherein X_1 is one or more elements selected from the group consisting of Be, Co, Cr, Fe, Nb, Ni, V, Zn, and Zr, and has a Fd3m structure or an amorphous structure.

10. A magnetic recording medium according to claim 1 , wherein the orientation-determining layer predominantly comprises an Nb-containing alloy X_2Nb, wherein X_2 is one or more elements selected from the group consisting of Be, Co, Cr, Fe, Ni, Ta, V, Zn, and Zr, and has a Fd3m structure or an amorphous structure.

11. A magnetic recording medium according to claim 1 , wherein the orientation-determining layer predominantly comprises CoTa, wherein the Ta content is 30-75 at% or CoNb wherein the Nb content is 30-75 at%, and has a Fd3m structure or an amorphous structure.

12. A magnetic recording medium according to claim 1 , wherein the orientation-determining layer predominantly comprises CrTa wherein the Ta contentis 15-75 at% or CrNb wherein the Nb contentis 15-75 at%.

13. A magnetic recording medium according to claim 1 , wherein the

orientation-determining layer predominantly comprises NiTa wherein theTa contentis 30-75 at% or NiNb wherein the Nb contentis 30-75 at%, and has a Fd3m structure or an amorphous structure.

14. A magnetic recording medium according to claim 1 , wherein the orientation-determining layer comprises a non-magnetic metal having a Fd3m structure.

15. A magnetic recording medium according to claim 1 or 2, wherein the orientation-determining layer comprises a non-magnetic metal having a C15 structure.

16. A magnetic recording medium according to claim 1 , wherein an orientation-enhancing layer is formed between the non-magnetic substrate and the orientation-determining layer.

17. A magnetic recording medium according to claim 16, wherein the orientation-enhancing layer comprises a material having a B2 structure or an amorphous structure.

18. A magnetic recording medium according to claim 16, wherein the orientation-enhancing layer predominantly comprises any one selected from the group consisting of NiAl, FeAl, CoAl, CoZr, CoCrZr, and CoCrC.

19. A magnetic recording medium according to claim 1 , wherein a plurality of orientation-determining layers are provided.

20. A magnetic recording medium comprising a non-magnetic substrate, an orientation-determining layer for arranging the crystal orientation of a layer provided directly thereon, a magnetic layer, and a protective layer, in order, wherein:

the orientation-determining layer has a crystal structure in which columnar fine crystal grains are inclined in a radial direction;

the ratio of a coercive force in a circumferential direction of the magnetic

layer (Hcc) to a coercive force in a radial direction of the magnetic layer (Hcr) is more than 1; and

the magnetic layer includes a plurality of magnetic films having an hcp structure and a predominant orientation plane of (110), and permits antiferromagnetic bonding to be formed therebetween.

21. A magnetic recording medium comprising a non-magnetic substrate, an orientation-determining layer for arranging the crystal orientation of a layer provided directly thereon, a non-magnetic undercoat layer, a magnetic layer, and a protective layer, the layers being formed on the substrate, wherein:

the non-magnetic undercoat layer has a bcc structure;

the orientation-determining layer is formed from an NiP alloy having an amorphous structure, and causes the non-magnetic undercoat layer to have a predominant orientation plane of (200);

the ratio of a coercive force in a circumferential direction of the magnetic layer (Hcc) to a coercive force in a radial direction of the magnetic layer (Hcr) is more than 1; and

the magnetic layer includes a plurality of magnetic films having an hcp structure and a predominant orientation plane of (110), and permits antiferromagnetic bonding to be formed therebetween.

22. A magnetic recording medium according to claim 1, wherein the orientation-determining layer comprises nitrogen or oxygen in an amount of at least 1 at%.

23. A magnetic recording medium according to claim 20, wherein the orientation-determining layer comprises nitrogen or oxygen in an amount of at least 1 at%.

24. A magnetic recording medium according to claim 21, wherein the orientation-determining layer comprises nitrogen or oxygen in an amount of at least 1 at%.

25. A process for producing a magnetic recording medium comprising a

non-magnetic substrate, an orientation-determining layer for causing the non-magnetic undercoat layer to have a predominant orientation plane of (200), a non-magnetic undercoat layer, a magnetic layer, and a protective layer, in order, wherein the non-magnetic undercoat layer has a bcc structure; and the magnetic layer includes a plurality of magnetic films having an hcp structure and a predominant orientation plane of (110), and permits antiferromagnetic bonding to be formed therebetween, which process comprises:

releasing from a release source film formation particles containing a material constituting the orientation-determining layer to form the layer, and then

depositing the particles onto a deposition surface, wherein a direction of a trajectory of the film formation particles is controlled such that a projection line of the trajectory of the particles formed on the deposition surface lies substantially along a radial direction of a non-magnetic substrate, and such that an incident angle of the trajectory of the particles is 10-75° with respect to the non-magnetic substrate.

26. A process for producing a magnetic recording medium according to claim 25, further comprising subjecting the orientation-determining layer to oxidation or nitridation.

27. A process for producing a magnetic recording medium according to claim 25, wherein the orientation-determining layer is formed by sputtering using a sputtering target as a release source of film formation particles.

28. A process for producing a magnetic recording medium according to claim 27, further comprising subjecting the orientation-determining layer to oxidation or nitridation using a sputtering gas containing oxygen or nitrogen while forming the orientation-determining layer.

29. A process for producing a magnetic recording medium according to claim 26 , wherein oxidation or nitridation is carried out by bringing the surface of the orientation-determining layer into contact with an oxygen-containing gas or a nitrogen-containing gas.

30. An apparatus for producing a magnetic recording medium comprising a non-magnetic substrate, an orientation-determining layer for causing the non-magnetic undercoat layer to have a predominant orientation plane of (200), a non-magnetic undercoat layer, a magnetic layer, and a protective layer, in order, wherein the non-magnetic undercoat layer has a bcc structure; and the magnetic layer includes a plurality of magnetic films having an hcp structure and a predominant orientation plane of (110), and permtis antiferromagnetic bonding to be formed therebetween, which apparatus comprises:

a release source for releasing film formation particles containing a material constituting the orientation-determining layer; and means for controlling a direction of a trajectory of the film formation particles released from the release source, wherein:

the direction-controlling means controls the direction of the trajectory of the particles such that a projection line of the trajectory of the particles formed on a deposition surface lies substantially along a radial direction of the non-magnetic substrate, and such that an incident angle of the trajectory of the particles is 10-75° with respect to the non-magnetic substrate.

31. A magnetic recording and reproducing apparatus comprising a magnetic recording medium, and a magnetic head for recording data onto the medium and reproducing the data therefrom, wherein:

the magnetic recording medium comprises a non-magnetic substrate, an orientation-determining layer for causing the non-magnetic undercoat layer to have a predominant orientation plane of (200), a non-magnetic undercoat layer, a magnetic layer, and a protective layer, in order, wherein the non-magnetic undercoat layer has a bcc structure; the orientation-determining layer has a crystal structure in which columnar fine crystal grains are inclined in a radial direction; the ratio of a coercive force in a circumferential direction of the magnetic layer (Hcc) to a coercive force in a radial direction of the magnetic layer (Hcr); is more than 1; and the magnetic layer includes a plurality of magnetic films having an hcp structure and a predominant orientation plane of (110), and permits antiferromagnetic bonding to be formed therebetween.